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UNITED STATES
DEPARTMENT OF THE INTERIOR
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HELIUM ACTIVITY
HELIUM RESEARCH CENTER

INTERNAL REPORT

A DIGITAL PRESSURE-READOUT DEVICE

BY

J. R. McVey

R. E. Noon

BRANCH Laboratory Services

PROJECT NO. 820.1

DATE October 1964

AMARILLO, TEXAS

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J. R. McVey[1] and R. E. Noon[2]

ABSTRACT

An accurate means of reading pressure in digital form in the 0 to 4000 ± 2 psi range has been developed for Applied Research. The device was needed for a fast, accurate method of reading the pressure of storage and shipping containers.

The device consists of four basic components which were integrated to produce a highly accurate system. The system consists of a transducer, transducer power supply, amplifier, and digital voltmeter.

INTRODUCTION

Quick, accurate measurement of pressure from 0 to 4000 ± 2 psi has become extremely important in large shipments of gas and some

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laboratory projects. An instrument was constructed for this purpose using production-line components from the companies indicated, and integrating them into a highly accurate, easily-read instrument. Other devices have been used for high-pressure measurement, (1,2,3)[3/]

[3/] Underlined numbers in parentheses refer to items in the list of references at the end of this report.

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but the need for an accurate digital readout of pressure at moderate cost led to the design of this unique instrument.

DESCRIPTION AND OPERATION

The measurement device (figure 1) consists of four units: pressure transducer, transducer power supply, amplifier, and digital voltmeter. The transducer is a Bourns Inc.[4/] model No. 2521 infinite-resolution

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[4/] References to names of specific equipment used are made to facilitate understanding and do not imply endorsement by the Bureau of Mines.

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type with a 0-5000 psi range.

The transducer power supply consists of seven 1.4 volt Eveready No. E42 mercury batteries. Current drain of the instrument is approximately 30ma, which allows acceptable battery life for intermittent service. The amplifier is a Kintel model No. 111BF. The amplifier required minor feedback circuit changes to give the proper gain

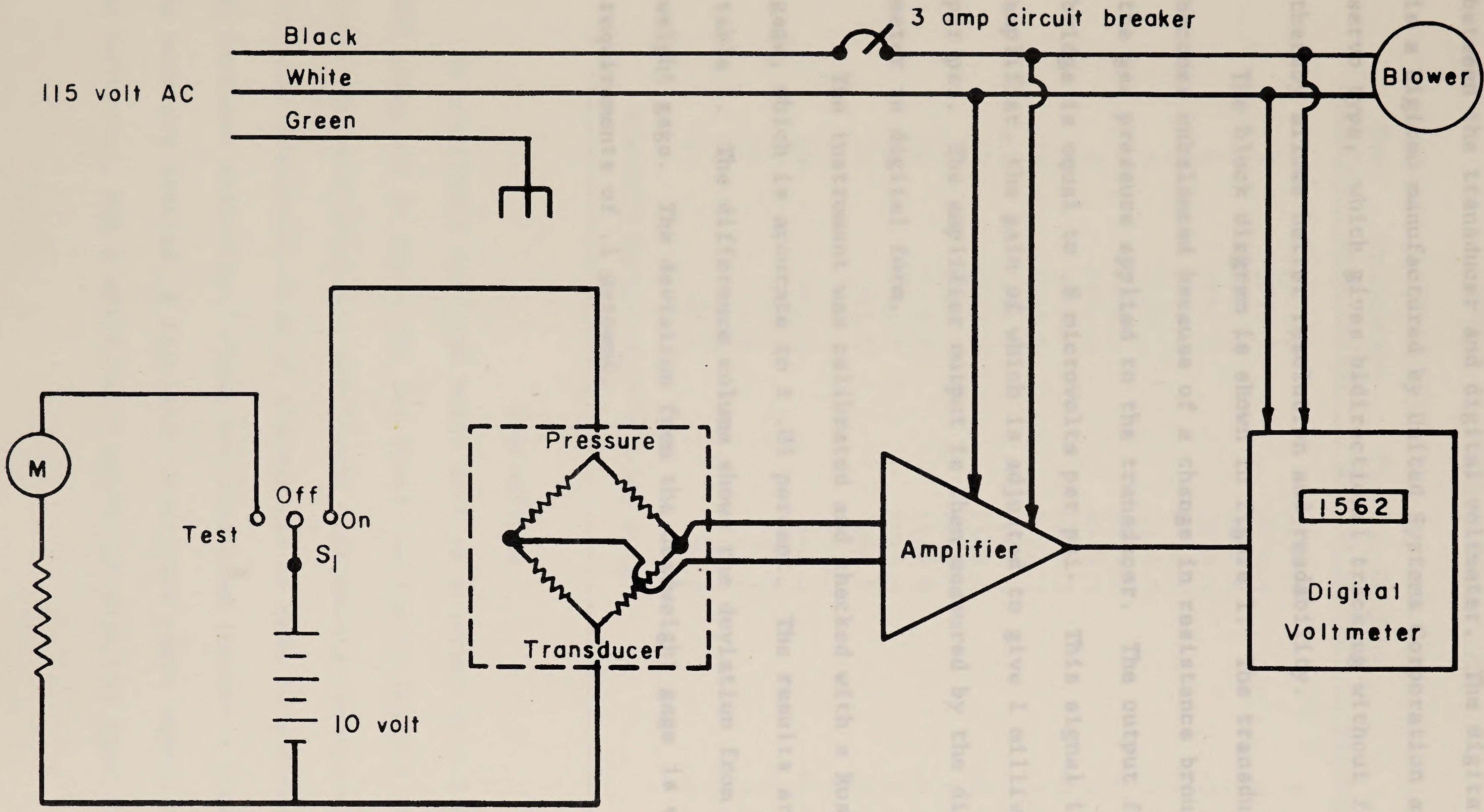

FIGURE 1.- Block Diagram

between the transducer and digital voltmeter. The digital voltmeter is a Digitec manufactured by United Systems Corporation and is of the servo type, which gives bidirectional tracking without flicker, and thereby allows better resolution and readability.

The block diagram is shown in figure 1. The transducer bridge becomes unbalanced because of a change in resistance brought about by the gas pressure applied to the transducer. The output from the bridge is equal to .8 microvolts per psi. This signal is sent to the amplifier, the gain of which is adjusted to give 1 millivolt output per psi. The amplifier output is then measured by the digital voltmeter in digital form.

The instrument was calibrated and checked with a Ruska deadweight gage, which is accurate to ± .01 percent. The results are shown in table 1. The difference column shows the deviation from the deadweight gage. The deviation from the deadweight gage is within our requirements of .1 percent.

TABLE 1. - Calibration data

Run Number	Deadweight Gage (psig)	Digital Readout Device (psig)	Difference
1	3301.2	3299.9	1.3
2	3299.9	3296.4	3.5
3	3091.6	3090.0	1.6
4	2898.0	2898.4	-0.4
5	2717.4	2718.8	-1.4
6	2549.1	2549.7	-0.6
7	2392.3	2393.0	-0.7
8	2245.8	2245.3	0.5
9	1984.0	1984.3	-0.3
10	1751.5	1752.7	-1.2
11	1646.0	1647.5	-1.5
12	1547.5	1548.4	-0.9
13	1288.9	1288.5	0.4
14	1142.8	1142.9	-0.1
15	1012.7	1013.5	-0.8
16	845.9	846.9	-1.0
17	591.4	592.3	-0.9
18	261.3	262.3	-1.0
19	139.3	139.4	-0.1
20	74.8	74.2	0.6
21	38.5	39.3	-0.8
22	20.4	20.6	-0.2

Standard Deviation = ± 1.146 psig.

CONCLUSIONS

An instrument has been built with an accuracy of ± 2 psig from 0 to 4000 psig and is now ready for field testing by Applied Research. Should the need arise for additional instruments incorporating the principle described, several changes can be made to further reduce cost and increase stability. These modifications include a transducer with the accuracy desired, a regulated transducer power supply to replace the batteries, and a solid state amplifier with the specific

operational capabilities. The system has good repeatability and has greater accuracy than present Bourdon tube-type gages covering the pressure range used and can be built for approximately $1,000.00.

The removal of operator error and ease of reading makes the instrument a versatile and accurate pressure measuring device for any laboratory.

REFERENCES

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